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ABSTRACT

The purposes of this study were to determine if preservice elementary teachers' attitude toward the metric system can be improved by completing metric units of instruction embedded in a methods course, and to investigate relationships among three types of training, attitude, and learning. The sample was comprised of 126 students in an undergraduate methods course at the Pennsylvania State University. Students were randomly assigned to one of three treatment groups and each took a knowledge and attitude pretest. After the students completed the metric instruction modules, they were posttested on knowledge and attitude. There was a significant attitude gain for all who received instruction. Several conclusions and suggestions for further research are given. (Author/NK)

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Metric Attitude and Achievement of Preservice
Elementary Teachers as a Function of Three
Instructional Approaches¹

by

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Rationale

The changeover to the SI Metric System is one of the major curriculum innovations in the public schools of the United States during the twentieth century. Educational efforts in metric changeover, both in this country and abroad, suggest that the changeover process includes at least two key components. First is the acquisition of measurement processes by learners. Difficulty in assimilating the SI Metric System is exacerbated by the lack of good measurement skills in the general public. The second major component is the development of positive attitude toward changeover. Both the acquisition of measurement processes and the development of positive attitude are recognized as conventional wisdom by science educators. In addition, the latter has been a targeted goal of research in the National Association for Research and Science Teaching for several years.

For purposes of this study, the measurement processes were defined as the ability to estimate using metric units of length, area, and volume.

The communications persuasion model of attitude development was used in this study. This model suggests the importance of three factors in developing

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positive attitude which are (1) a credible source, (2) manipulative measurement, and (3) active involvement in the formulation of conclusions.

Research with the IMPACT leadership training model over several years has shown consistent gains in attitude toward changeover as a result of the instruction provided. The question addressed in this study is "Would certain instruction in estimation skills influence attitude change favorably toward the metric system?"

Problem

There are two problems investigated in this study. First, the effect of three different types of instruction on attitude toward changeover was examined. Second, the relationship between achievement (defined as estimation skill acquisition) and attitude gain after instruction was studied.

Design

This study used 126 undergraduate methods students who were randomly assigned to one of three methods of instruction aimed at developing estimation skills. The students were classified into three levels of estimation skill achievement, based upon their posttest scores. The division was made into three equal size groups based on these scores. This design is depicted in Figure 1.

Post Achievement Scores	Treatment Groups		
	1	2	3
High			
Moderate			
Low			

Figure 1. 3X3 ANOVA design.

The three instructional strategies employed were those used in the study by Attivo and Trueblood (1980). The students were pretested on length, area, and volume estimation skills and on attitude toward metric changeover. Students with high estimation skills were screened from the study based on the pretest score. At the end of the training, which was mastery oriented, students were given a forty item test of metric estimation skills.

The criterion variable is a twenty-two item Likert instrument designed by Shrigley and Trueblood (1979) to measure an individual's attitude toward metric changeover. The instrument has three subscales. The first subscale measures the impact of the changeover, on one's self, and has a reliability of 0.85. The second subscale measures the impact of changeover on the United States and has a reliability of 0.69. The third subscale assesses the individuals ability to learn and use the metric system. It has a reliability of 0.83. Overall, the reliability of the instrument is 0.91.

The statistical analysis was as follows. In order to determine whether significant pre to post gains in attitude occurred, a repeated measures analysis of variance was run with the repeated measures being on the test factor. Next, an unweighted means analysis of variance (3X3) was run on the criterion of attitude posttest scores. This analysis sought to determine whether there was any differential affect due to instruction, achievement, or any interaction affects. The third level of analysis was a series of point-biserial correlations between estimation skill achievement and gains in estimation skills with post attitude scores.

Findings

The findings of the repeated measures analysis of variance data can be found in Table 1. For brevity, only the F values for the pre-posttest

component (within subjects) is listed. It can be seen that there was a significant testing effect for the total and all three subscales. In each case, the posttest was higher than the pretest indicating a substantial gain in attitude. It should be noted that this occurred independent of the instructional treatments and of the achievement level.

Table 1
ANOVRM on Pre-Post Attitude Scores
(Within Subjects)

Total	
F (1,45) = 29.06, p <.05	

Subscale 1	"Impact on Self"
F (1,45) = 8.12, p <.05	

Subscale 2	"Impact on USA"
F (1,45) = 9.41, p <.05	

Subscale 3	"Ability to Learn and Use Metrics"
F (1,45) = 19.45, p <.05	

In the next analysis, three levels of instruction were crossed with three levels of estimation skills and the criterion of post attitude score was analyzed. The first finding is that no significant differences were observed among the means of the three treatment groups for either the total attitude score or the three subscores. Among the achievement groups, the high achievement group outscores the low achievement group only for Subscale 1. In all other cases, there were no differences among the achievement groups. Since it was expected that achievement and attitude would be related, this finding is somewhat surprising.

There were no significant interactions among treatment groups and achievement levels. When the above analysis was replicated using a second estimation skills posttest, identical results were obtained.

Correlation analysis between mean estimation scores and estimation gains scores with attitude posttest scores were run. These results are found in Table 2. None of the correlations were significantly different from zero indicating a lack of relationship between attitude and achievement.

Table 2
Correlations Among Estimation Scores
and Post Attitude Scores

	Estimation Skills		
	1	2	3
Length and Attitude	.09	-.06	.01
Area and Attitude	.13	.12	.14
Length Δ		.02	
Area Δ		.01	
Volume Δ		-.13	

Conclusions and Discussions

It appears that the communications persuasion model or some other commonality in the instructional treatments seemed to have more effect upon the attitude scores than differential instruction. The other commonalities might be the fact that the instruction was self-paced, involved training to mastery, or involved measurement.

The effect on attitude gain seems to have been pervasive to all three attitudinal components designed into the current instrument.

It appears that estimation skills should be investigated as something different and unique from attitude scores due to the low correlations.

Problems and Further Research

It appears that some instruction in metric estimation skills results in increased attitude toward the metric system and changeover. Further research should be conducted to determine if achievement gains are also a concomitant of other kinds of metric instruction. For example, would didactic-oriented instruction result in attitude gains as striking?

The results suggest that we continue to refine the theoretical relationship between instructional action such as decisions and strategies that affect the learner, and attitudinal and measurement components of the curriculum.

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